

## **SUSTAINED HIGH CONCENTRATIONS OF PCBs IN FAROESE PREGNANT WOMEN DESPITE DIETARY INTERVENTION**

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### ***Introduction***

Faroe Islanders have consumed pilot whales since Medieval times. However, the pilot whale meat has been found to be contaminated with methylmercury and the blubber with POPs, including PCB and DDE. Since 1985 investigations have therefore been carried out in the Faroe Islands to establish the exposure levels in pregnant women and the potential adverse effects of the pollutants on the fetus. Current evidence from the Faroes indicates that prenatal exposure to methylmercury and, to a lesser degree, PCBs may impair fetal and childhood development. In August 1998, the Faroese health authorities therefore advised women to reduce their intake of pilot whale meat and blubber to protect the fetus against adverse effects from these food contaminants. This study describes the serum PCB concentrations of consecutive groups of pregnant women before and after the advisory.

### ***Methods and Materials***

#### ***Pre-Advisory Cohort***

During 1994-1995, a cohort was collated of 182 pregnant women during a 12-month period<sup>1, 2</sup>. The women were living in the central and northwestern Faroe Islands, excepting the capital of Tórshavn. About 64% of all pregnancies in the area were included. A brief dietary questionnaire was filled in on intake of whale meat and blubber, and other foods during pregnancy. Maternal serum was obtained from 173 of the women at the last antenatal consultation at pregnancy week 34. The serum was analyzed at the National Center for Environmental Health, Centers for Disease Control, by a two-stage solid-phase extraction followed by gas chromatography analysis with electron capture detection<sup>3</sup>.

#### ***Post-Advisory Cohort***

This cohort was also gathered during a 12-month period, i.e., during 2000-2001. This report presents the first results from this study. Two individuals served as interviewers, a clinical dietician and a midwife. During this period, a total of 486 pregnant women were eligible for inclusion, and 298 (65.6%) were invited to participate, of whom 189 (66.4%) agreed to participate. However, 8 subjects (2.7%) did not want to continue, 14 (4.7%) did not approve the blood sampling, and 19 (6.4%) accepted to participate but were not included because of scheduling problems. The final number of participants was 148 (49.7%).

To cover the daily dietary variations we used 24-hour recall interviews (24 h recall), as well as a food diary (FD), where all food consumed during one day at a time was reported by each woman. These registration sheets were in accordance with the previously performed dietary survey in the Faroes<sup>4</sup>. We interviewed the women at home when they were in 28<sup>th</sup>, 33<sup>rd</sup> and 38<sup>th</sup> weeks of pregnancy. All together we obtained 409 24-h recall interviews (116 women completed all three interviews, 29 did two, and 3 women only one interview). A total of 732 FD recordings were collected (average of five FDs per woman).

#### *Sample Analysis*

Blood samples from the post-advisory cohort were taken at week 37. The analytical procedure used have been described previously<sup>5</sup>. Briefly, an aliquot (2 ml) of the serum was spiked with a solution of internal standards (delta-HCH, <sup>13</sup>C<sub>6</sub>-p,p-DDE and six <sup>13</sup>C<sub>6</sub>-PCBs) and was shaken for 1 minute with formic acid (2 ml). The analytes were subsequently extracted into 10 ml of a mixture of toluene/n-hexane (1:1, v/v). After centrifugation, the organic phase was transferred into a glass tube and evaporated to approximately 100 to 500 µl in a vacuum centrifuge. The concentrated extracts were purified using silica gel (Silica Gel 60 from Merck) and a mixture of toluene/n-hexane (1:4, v/v) as eluent. Calibration standards prepared in bovine plasma were processed and measured in the same manner as the samples to be analyzed. Sample analysis was performed on a Hewlett-Packard gas chromatograph (HP 5890 II) interfaced with a mass spectrometer (MS Engine 5989A). Operating conditions were as follows: GC inlet: split-splitless, splitless injection (2 µl) with injector at 250°C; GC column, DB-5 (30m x 0.25 mm x 0.25 µm); carrier gas Helium with a flow rate of 1 ml/min; GC temperature ramp: 140°C, initial 0.5 min, 10°C/min to 260°C, 20°C/min to 290°C and held for 6 min. The MS was operated in the negative mode (NCI) with methane reagent at source pressure of 2.1 torr, ion source temperature at 200°C, quadrupole temperature at 100°C and interface temperature at 280°C. During an analysis, specific ions (m/z) for each analyte were monitored. Each analytical series included a reagent blank and controls for accuracy and precision. As quality control for accuracy served remaining material of the 27th ring test conducted by Professor J. Angerer (University of Erlangen, Germany), which was stored at 20°C until used. The quality control for monitoring precision was prepared in the laboratory by spiking of pooled plasma of low-level exposed subjects with a defined quantity of the analytes.

#### **Results**

The two cohorts were quite similar with respect of age, number of previous births and smoking habits, table 1.

Table 1: Characteristics of the two Faroese cohorts.

<i>Characteristic</i>	<i>Pre-Advisory Cohort</i>	<i>Post-Advisory Cohort</i>
Maternal age in years (mean±SD)	28.0 ± 5.8	29.6 ± 7.5
Previous births (0/1/at least 2) in %	29.7/29.1/41.2	31.0/32.7/36.3
Non-smoking during pregnancy in %	68.7	73.9

Based on calculations of the 409 24-h recall interviews and the 732 food diary recordings the intake of pilot whale meat and blubber in average per day was 1.5 g and 0.6 g. The corresponding numbers for sea birds and ocean fish were 3.0 g and 40.2 g respectively.

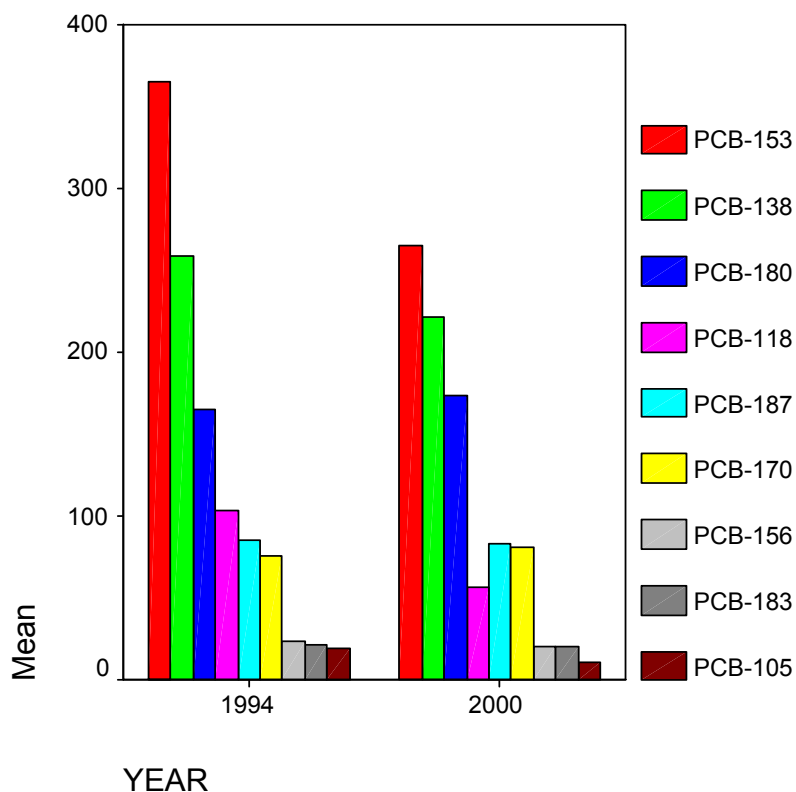
When the two groups of pregnant women are compared there is a significant reduction in the concentration of the congeners 153, 118 and 105. However, the reduction in total PCB is not significant, table 2 and figure 1.

Table 2. The congeners with the highest concentrations in both cohorts and the sum of all congeners analysed. ng per gram lipid.

PCB Congener	Pre-Advisory cohort				Post-Advisory cohort			
	Min	Max	Mean	St. Dev.	Min	Max	Mean	St. Dev.
153	10.0	3933.0	365.3	389.7	12.2	1756.8	264.7	248.0
138	22.0	3529.0	259.0	315.8	13.3	1250.4	221.8	204.4
180	9.0	1761.0	165.2	193.6	6.9	889.4	173.2	153.9
118	5.0	1413.0	103.7	132.6	3.8	344.9	56.9	58.1
Sum PCB*	69.0	13501.0	1296.5	1304.9	44.1	5430.6	1059.8	889.3

\*Calculated as sum of all congeners detected

Figure 1: Average concentrations of main PCB congeners in the pre-advisory (1994) and post-advisory (2000) cohorts (in ng/g lipid).



## Discussion

The recorded dietary intake of pilot whale meat and blubber is remarkably low when compared with the last dietary survey in 1981-82, where the average consumption of pilot whale meat among adult men and women was about 10-fold higher. This reduction is most likely to be a result of the recommendations issued by the health authorities to pregnant women to avoid contaminated seafood, such as pilot whale meat and blubber.

The PCB concentrations are elevated at both examinations and therefore do not reflect the change in dietary habits. The dietary advisory regarding consumption of contaminated blubber from August 1998 therefore apparently has not yet led to a significant reduction of body burdens of PCBs in pregnant women in the Faroes.

The results from the dietary survey also showed a very significant reduction in whale meat intake, and blood analysis shows a corresponding reduction in the mercury concentration levels. This observation suggests that the dietary change recorded is likely to be true. However, the PCB concentrations remain to be high and must be considered to be a continuing potential health problem in the Faroese community, especially in regard to prenatal exposure. The long half-life of these organochlorine compounds, as compared to methylmercury appears to explain the sustained PCB concentration levels.

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